US009402702B2

(12) **United States Patent**
Binothman

(10) **Patent No.: US 9,402,702 B2**
(45) **Date of Patent: Aug. 2, 2016**

(54) **FEATHER IMPING SYSTEM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 258 days.

(21) Appl. No.: **14/148,179**

(22) Filed: **Jan. 6, 2014**

(65) **Prior Publication Data**

US 2014/0215776 A1 Aug. 7, 2014

Related U.S. Application Data

(62) Division of application No. 13/757,348, filed on Feb. 1, 2013, now Pat. No. 8,845,226.

(51) **Int. Cl.**
A61D 1/00 (2006.01)

(52) **U.S. Cl.**
CPC . ***A61D 1/00*** (2013.01); *Y10T 24/46* (2015.01); *Y10T 24/4691* (2015.01); *Y10T 29/49947* (2015.01); *Y10T 403/459* (2015.01); *Y10T 403/55* (2015.01); *Y10T 403/557* (2015.01); *Y10T 403/559* (2015.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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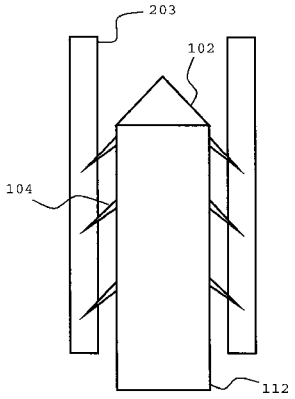
(57) **ABSTRACT**

A feather imping system includes a plurality of feather imping pins that attach a donor feather to a receiving feather. The feather imping pin is inserted into a receiving feather shaft of the receiving feather. Feather imping is performed using the feather imping pin that connects the donor feather and the receiving feather. The feather imping pin fits inside both the receiving feather shaft of the receiving feather and a donor feather shaft of the donor feather.

8 Claims, 13 Drawing Sheets



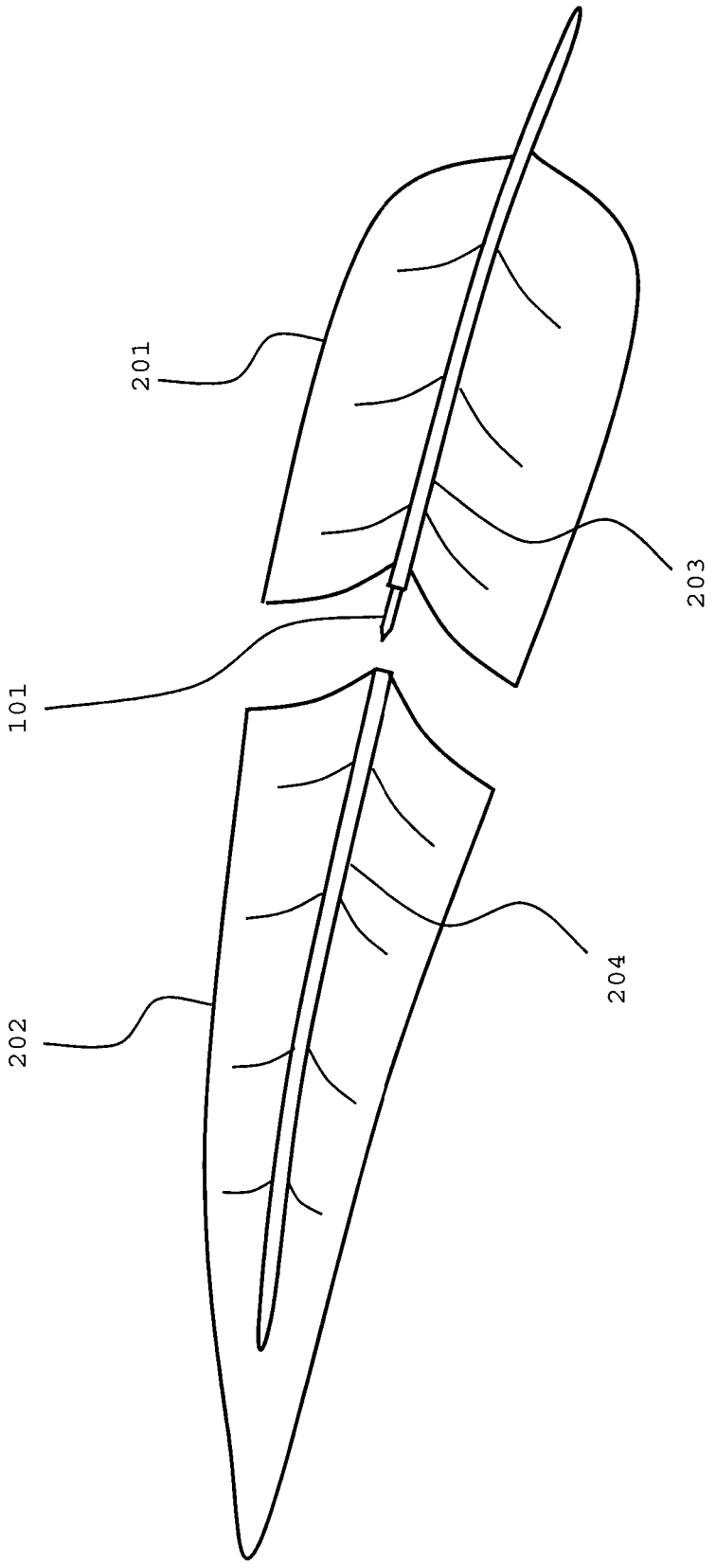


FIG. 1

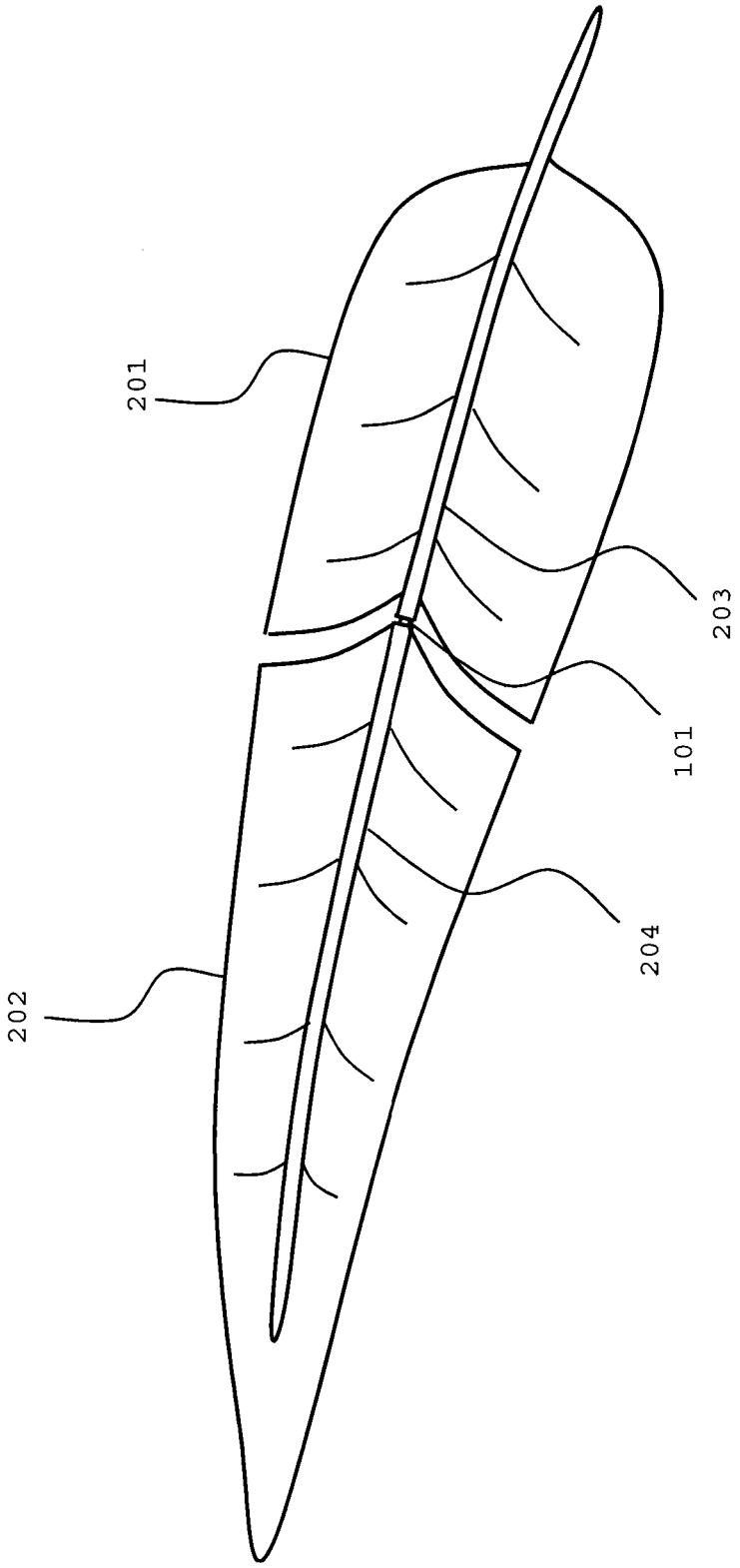


FIG. 2

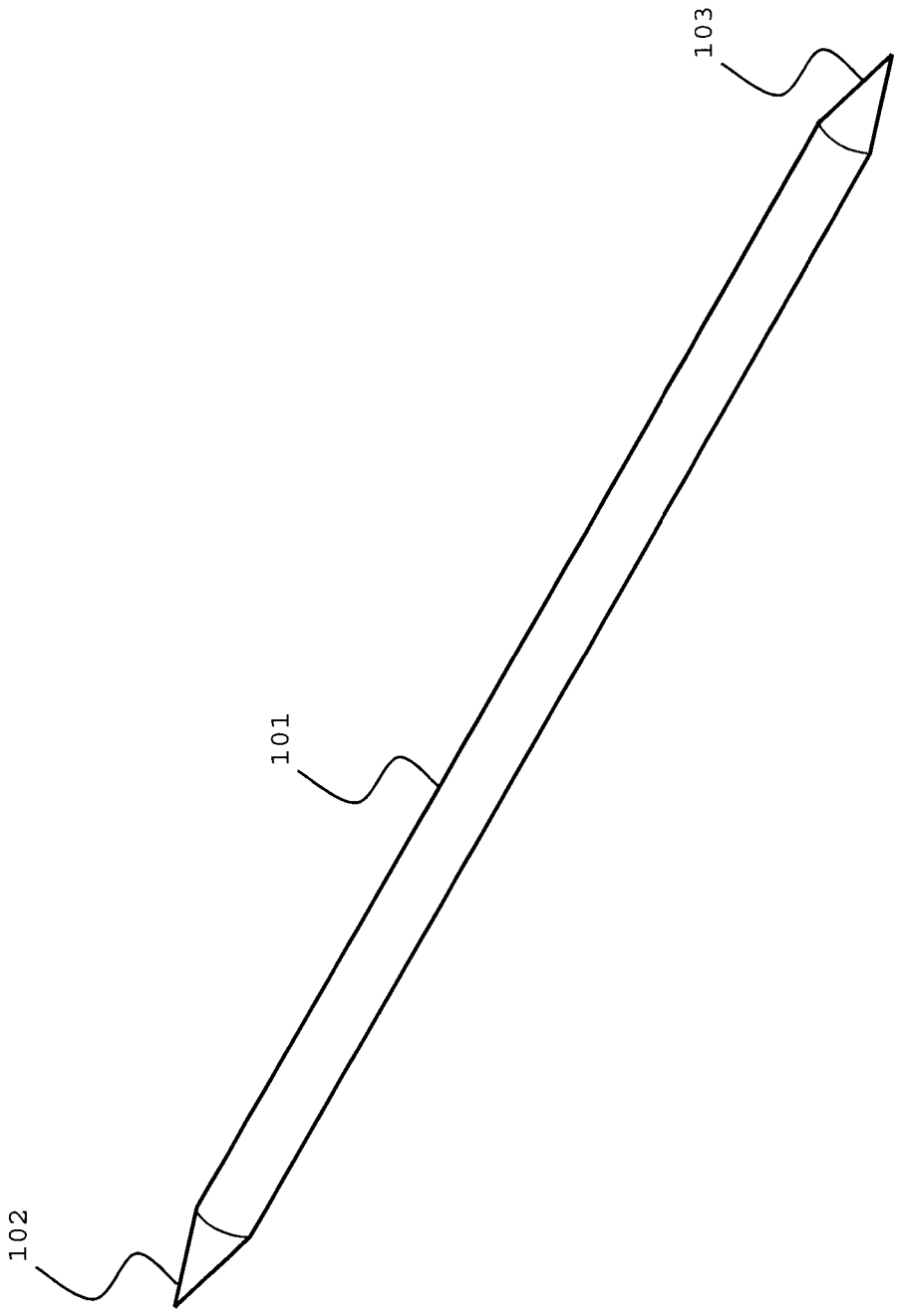


FIG. 3

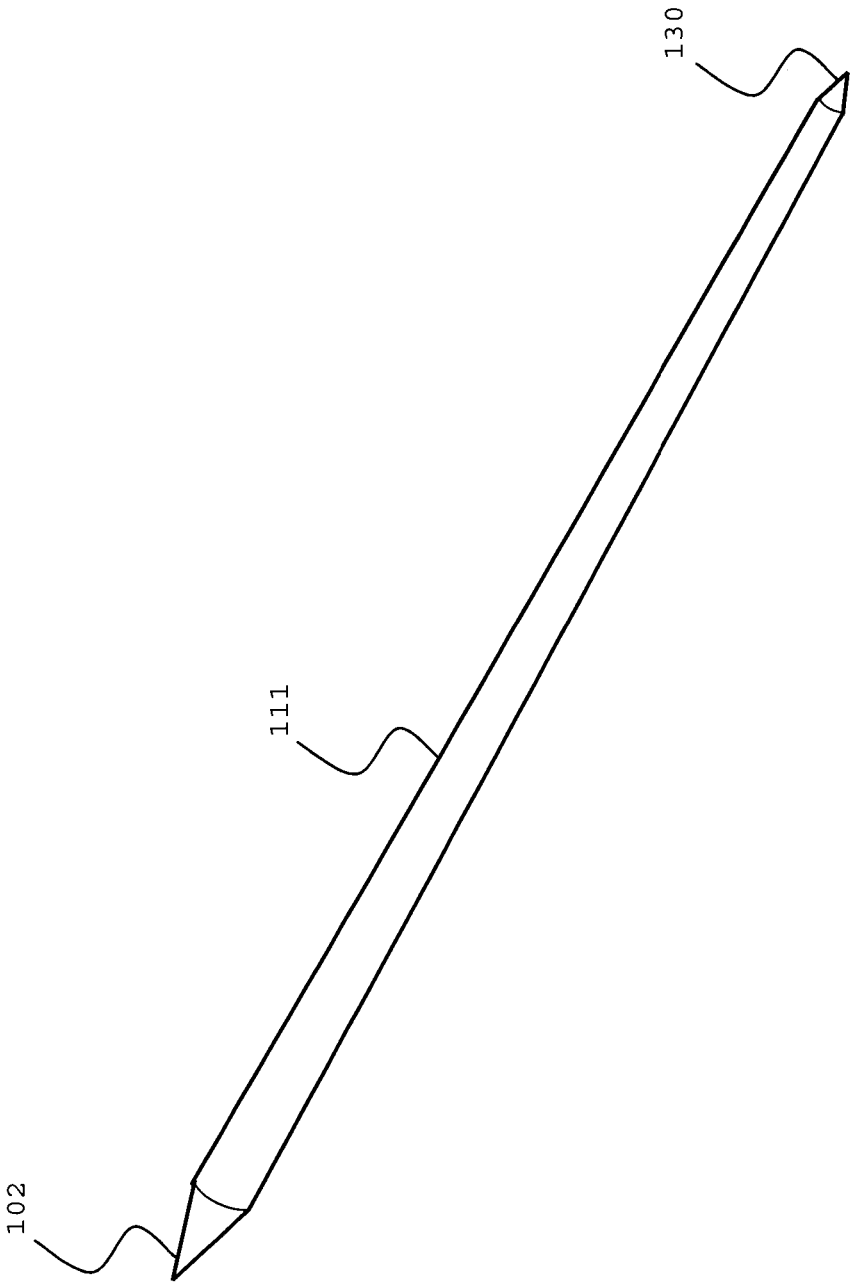


FIG. 4

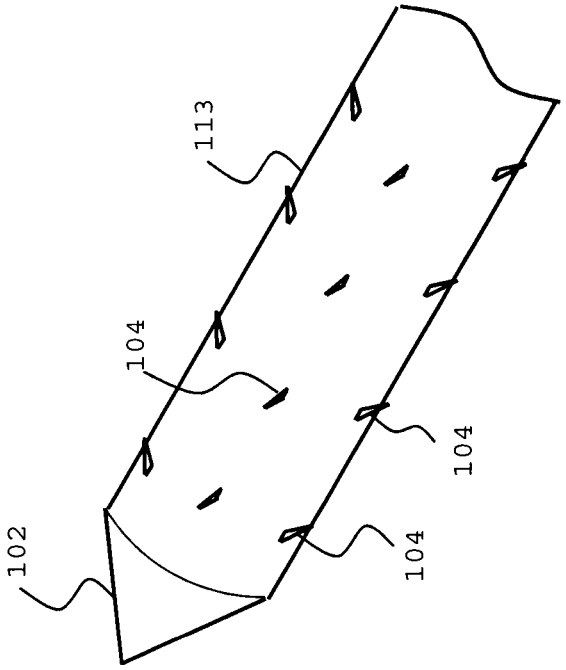


FIG. 5b

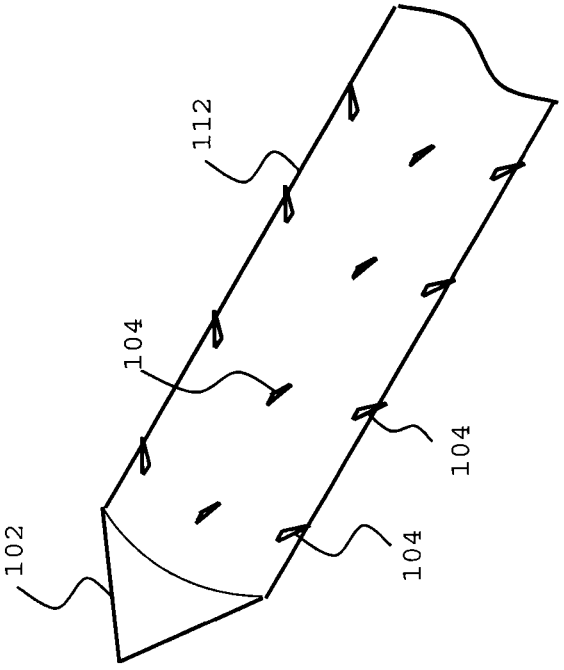


FIG. 5a

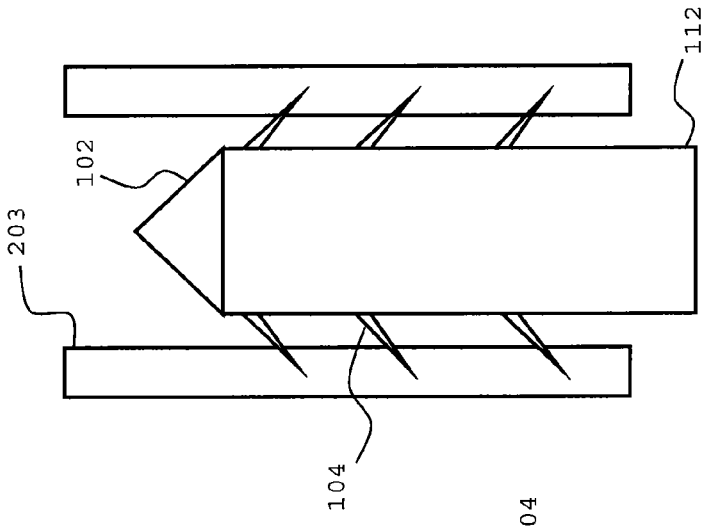


FIG. 6c

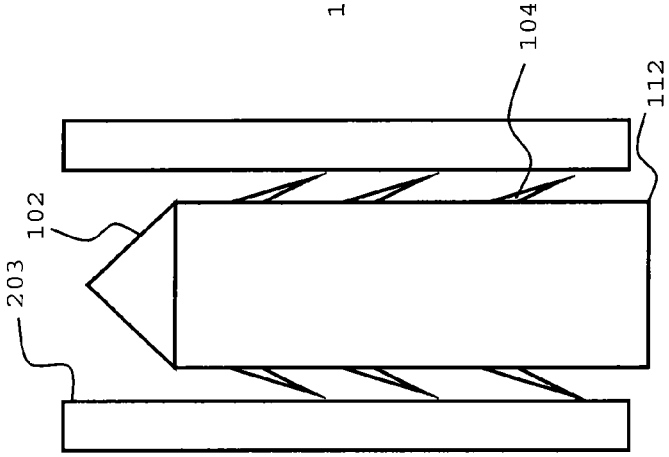


FIG. 6b

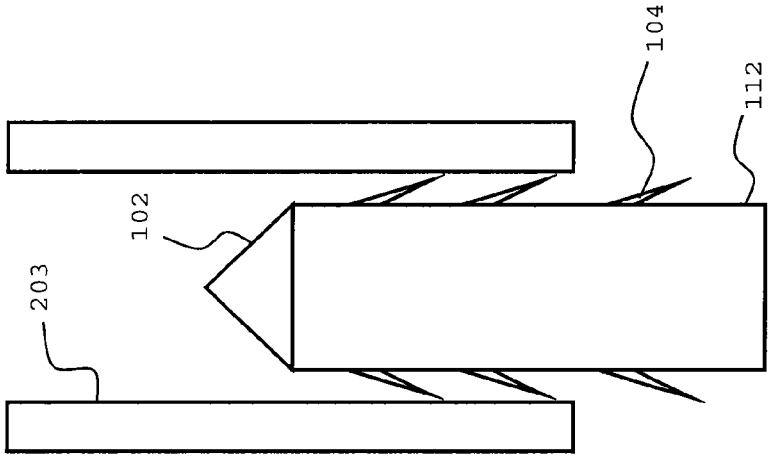


FIG. 6a

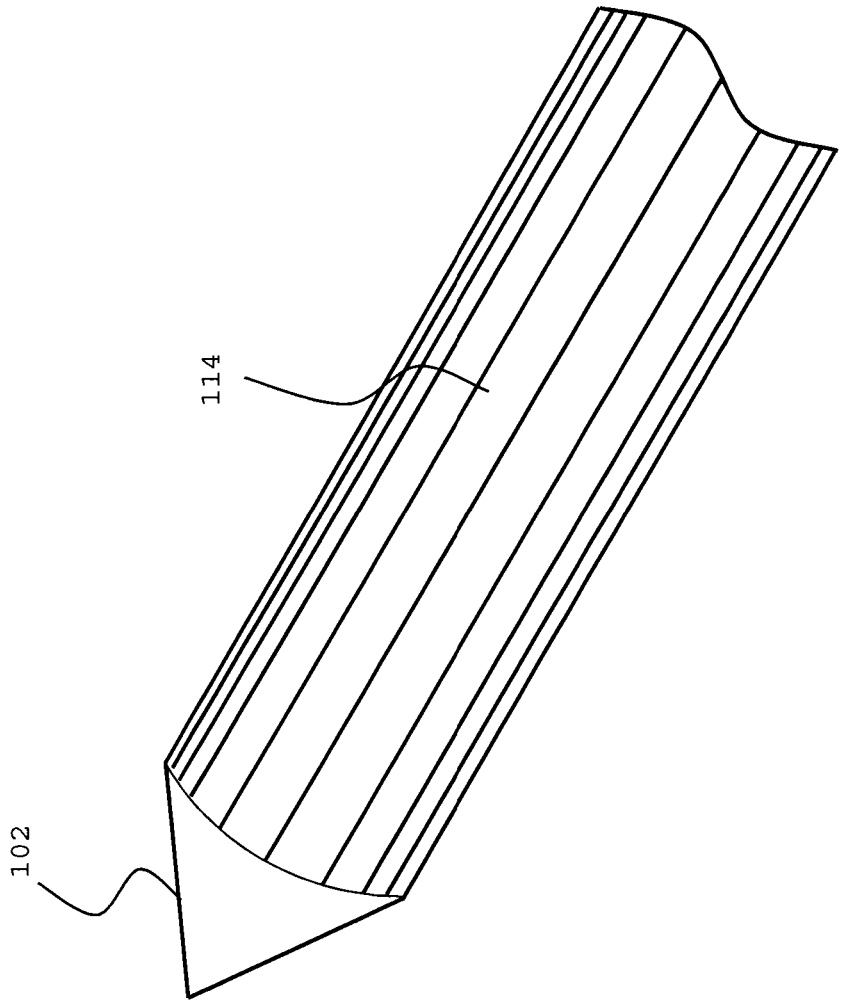


FIG. 7

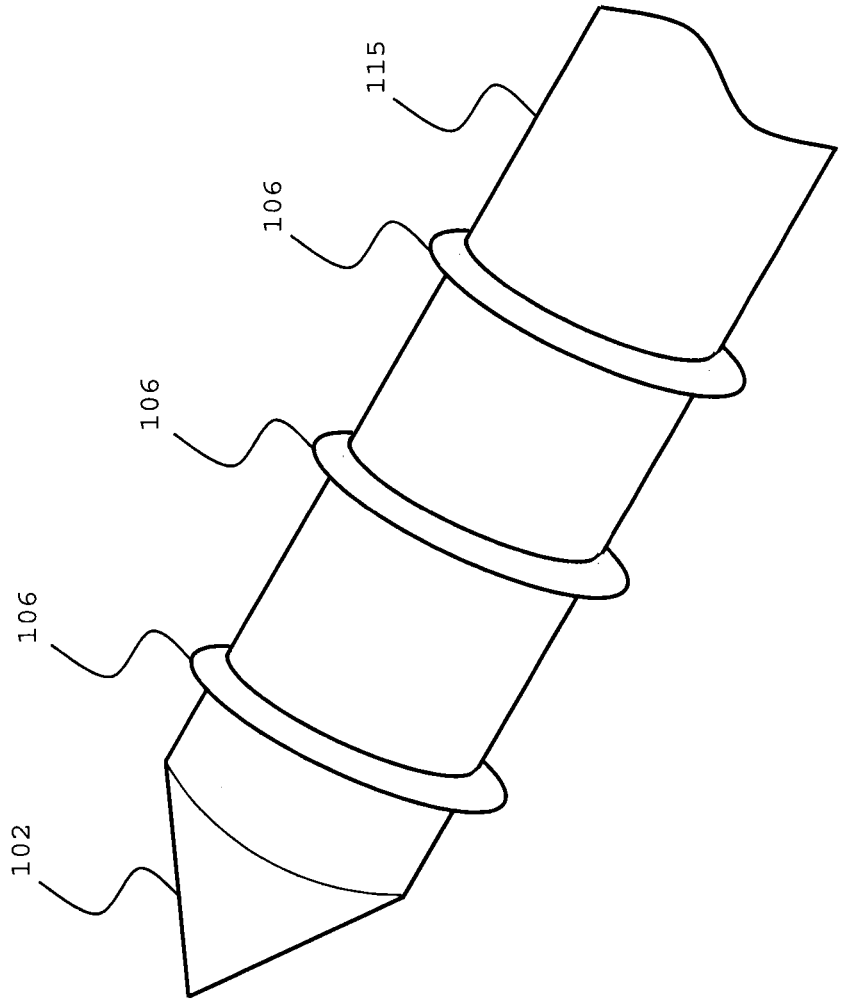


FIG. 8

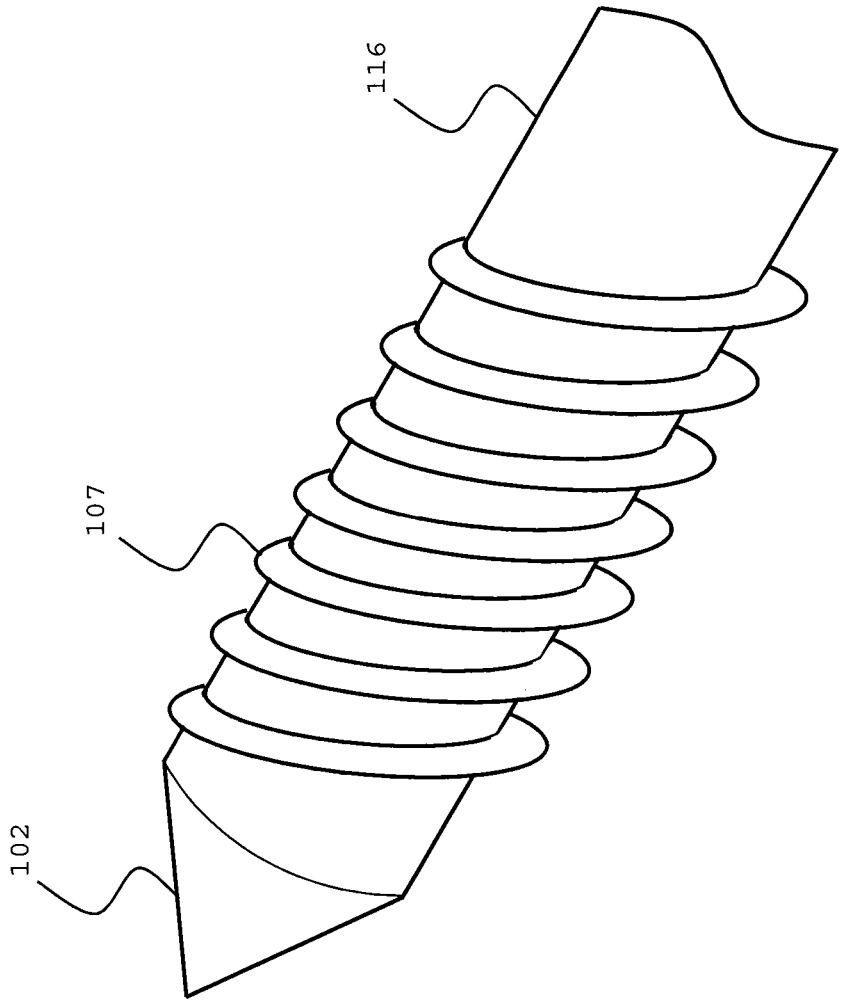


FIG. 9

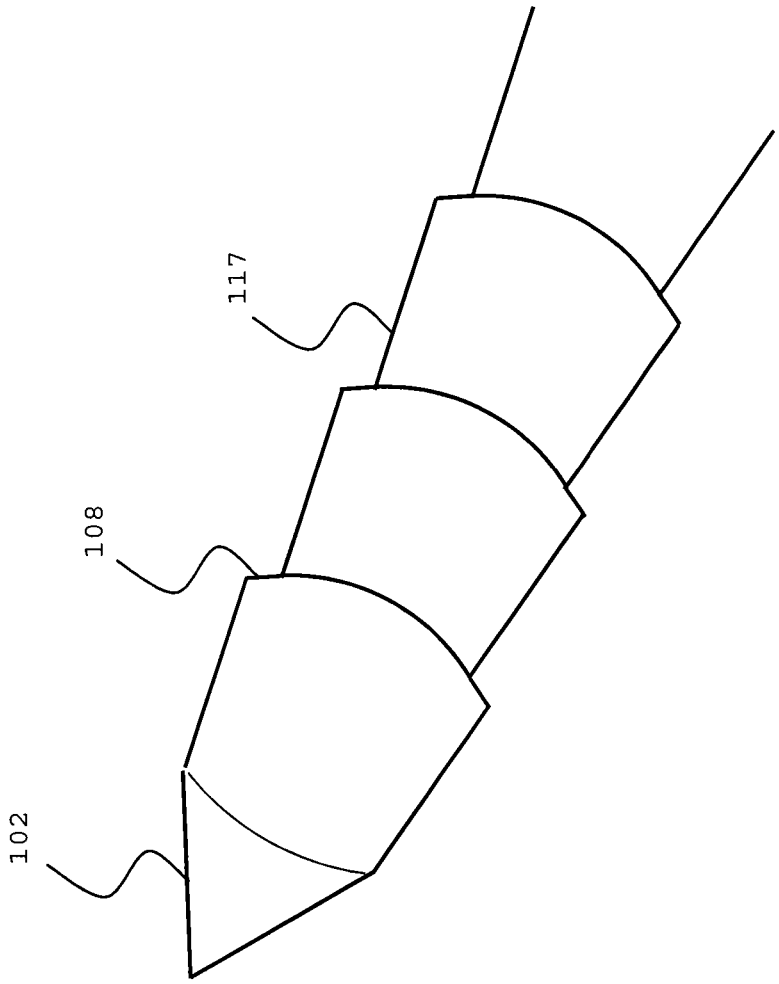


FIG. 10

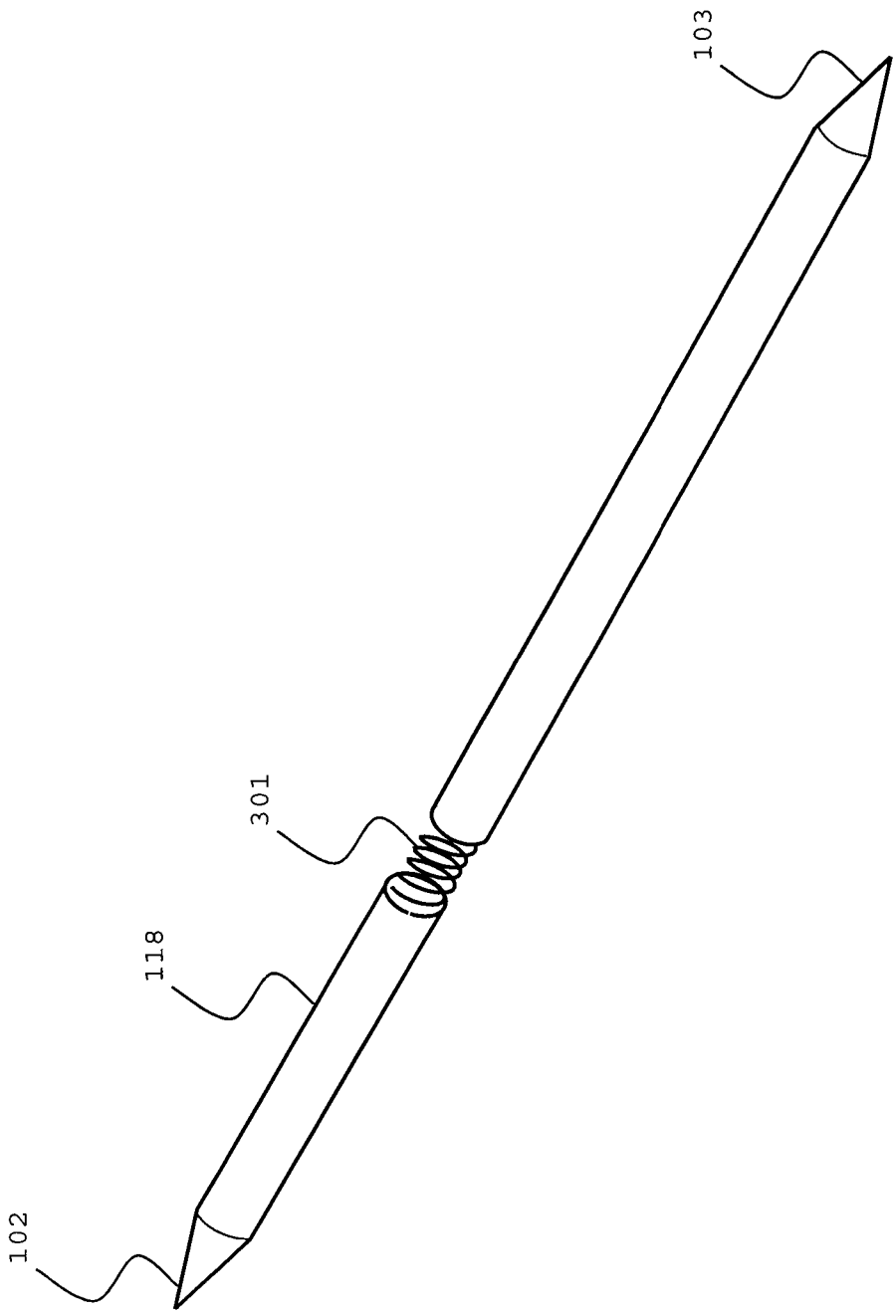


FIG. 11

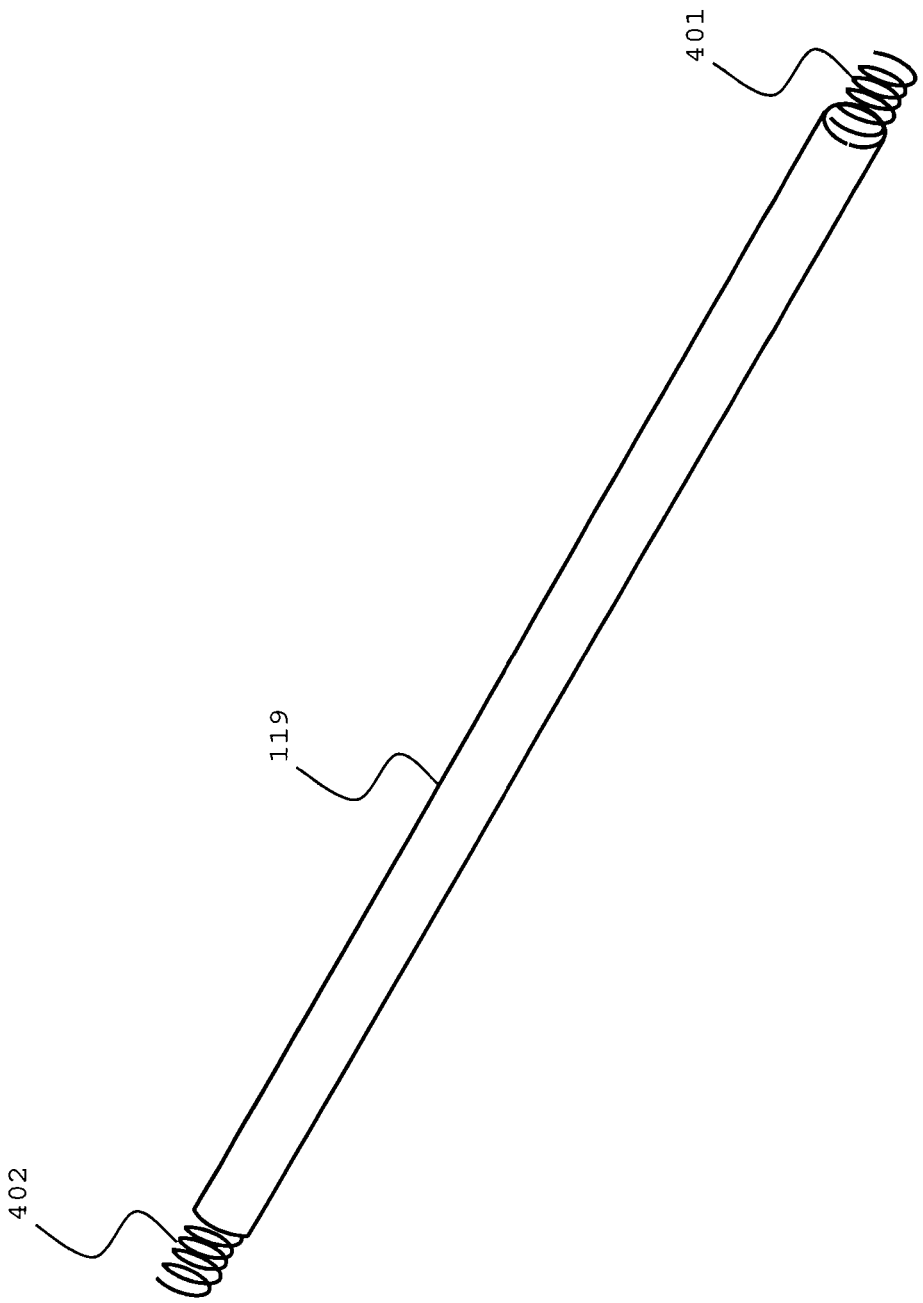


FIG. 12

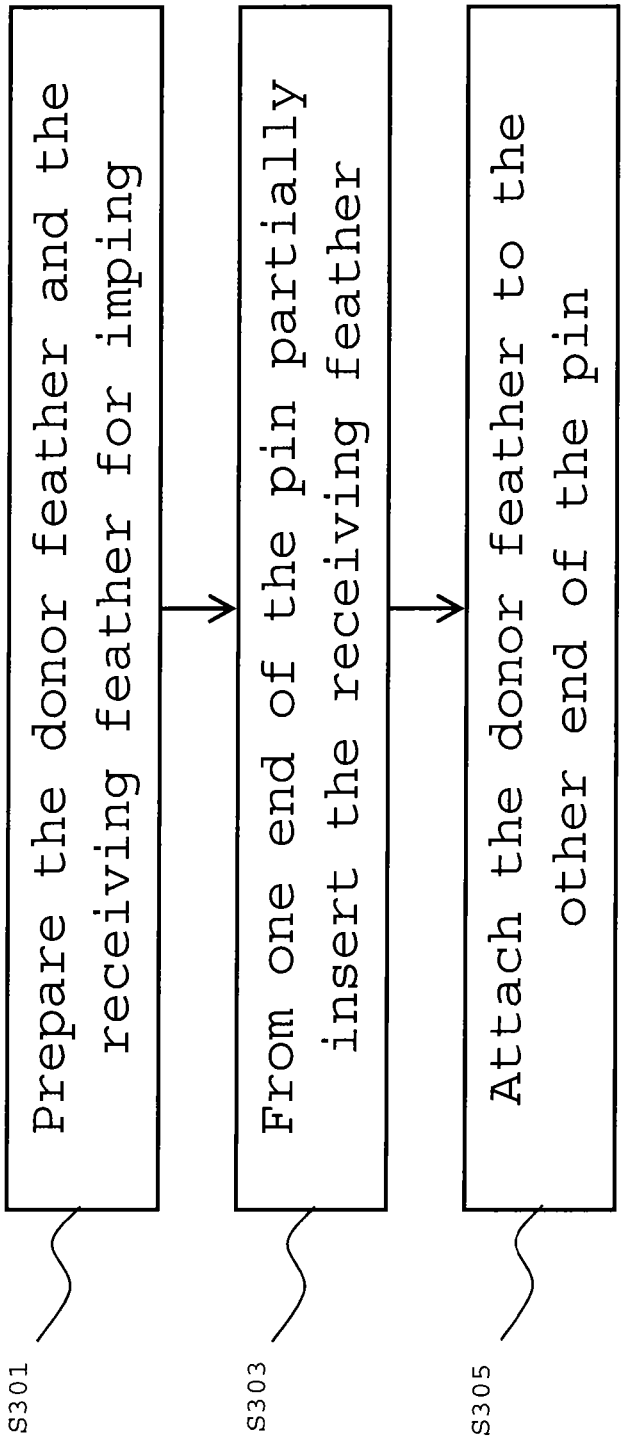

Prepare the donor feather and the receiving feather for imping
From one end of the pin partially insert the receiving feather
Attach the donor feather to the other end of the pin
S301
S303
S305

FIG. 13

FEATHER IMPING SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a Divisional of and is based upon and claims the benefit of priority under 35 U.S.C. §120 for U.S. Ser. No. 13/757,348, filed Feb. 1, 2013. The present application contains subject matter related to that described in commonly owned Saudi application No. 110310420, filed May 19, 2012, at the Saudi Arabian General Directorate of Industrial Property Filing and Granting, the entire contents of each which are incorporated herein by reference.

GRANT OF NON-EXCLUSIVE RIGHT

This application was prepared with financial support from the Saudi Arabian Cultural Mission (SACM), and in consideration therefore the present inventor has granted The Kingdom of Saudi Arabia a non-exclusive right to practice the present invention.

BACKGROUND

Field of the Disclosure

This disclosure relates to a feather imping pin, and more specifically, to a feather imping pin with a roughened surface.

SUMMARY

This disclosure describes a feather imping pin.

A feather imping pin attaches a donor feather to a receiving feather, the feather imping pin includes a shaft that is cylindrical with two ends and a diameter sized to slide within a receiving feather shaft of the receiving feather, and a donor shaft of the donor feather such that the shaft has a roughened surface, and the shaft fits into the receiving feather shaft of the receiving feather on one end and fits into a donor feather shaft of the donor feather on the other end so that the opposing shaft ends of the receiving feather and donor feather oppose one another and interconnect the receiving feather to the donor feather.

According to one embodiment, the feather imping pin is made of materials that have similar density to that of a feather and has similar flexibility to that of a feather.

According to one embodiment, the feather imping pin has a roughened surface.

According to one embodiment, the feather imping pin has a toothed surface. The teeth on the feather imping pin surface protrude outward. According to one embodiment, the teeth are tilted against the pin surface. According to one embodiment, the teeth are tilted in different directions against the pin surface to secure the feather imping pin within a receiving and/or a donor feather, and prevent rotation of the receiving and/or donor feather around the feather imping pin, and/or prevent movement of the receiving and/or donor feather along the feather imping pin.

According to one embodiment, the feather imping pin has a grooved surface. The grooves on the feather imping pin surface may be longitudinal, around an axis of the feather imping pin, or any combination thereof.

According to one embodiment, the feather imping pin has one or more roughened ends. Each roughened end may include a spring attached to that end.

According to one embodiment, the feather imping pin is extendable. The feather imping pin may be extendable via one or more spring-loaded sections along the feather imping pin.

According to one embodiment, there is provided a method of imping feather via a feather imping pin that is light and flexible as a feather and has a roughened surface.

According to one embodiment, glue is applied to the feather imping pin to make the pin more secure and more coherently attached.

According to one embodiment, a kit is provided for quick feather imping. The kit may include any of the disclosed feather imping pin embodiments. The kit may include a feather imping cutter. The kit may include a measurement device to measure the cross-section or other size of the receiving and/or donor feather. The kit may include a marker to mark the receiving and or donor feather before cutting. The kit may include glue for more secure and coherent feather imping.

The disclosed embodiments may be used for imping different types of feather.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the present application and many of the advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. **1** is an exemplary embodiment of a donor feather, a receiving feather, and a feather imping pin that attaches the donor feather to the receiving feather such that the feather imping pin is inserted into a shaft of the receiving feather;

FIG. **2** is an exemplary embodiment of a donor feather, a receiving feather, and a feather imping pin that attaches the donor feather to the receiving feather such that the donor feather and the receiving feather are connected to each other using the feather imping pin;

FIG. **3** is an exemplary embodiment of a feather imping pin having two ends such that the two ends have a same size;

FIG. **4** is an exemplary embodiment of a feather imping pin having two ends such that the two ends have different sizes;

FIG. **5***a* is an exemplary close-up view of an exemplary embodiment of a feather imping pin with tilted teeth, where the tilted teeth are tilted in a same direction;

FIG. **5***b* is an exemplary close-up view of an exemplary embodiment of a feather imping pin with tilted teeth, where the tilted teeth are tilted in opposite directions;

FIGS. **6***a*, **6***b*, and **6***c* are exemplary cross sectional close-up views of an exemplary embodiment of a feather imping pin with tilted teeth, where the tilted teeth are tilted in a same direction, and the feather imping pin is being inserted into a feather shaft and the tilted teeth are getting engaged with the feather shaft;

FIG. **7** is an exemplary close-up view of an exemplary embodiment of a feather imping pin with longitudinal grooves;

FIG. **8** is an exemplary close-up view of an exemplary embodiment of a feather imping pin with circular grooves;

FIG. **9** is an exemplary close-up view of an exemplary embodiment of a feather imping pin with spiral grooves;

FIG. **10** is an exemplary close-up view of an exemplary embodiment of a feather imping pin with half-cone grooves;

FIG. **11** is a an exemplary embodiment of a feather imping pin that is extendable via one spring-loaded section along the feather imping pin;

FIG. **12** is a an exemplary embodiment of a feather imping pin that is roughened at two ends using two springs; and

FIG. **13** is a flowchart of a method for imping a donor feather and a receiving feather using a feather imping pin.

DETAILED DESCRIPTION

Referring now to the drawings, FIG. **1** illustrates an exemplary embodiment of a donor feather **202**, a receiving feather **201**, and a feather imping pin **101** that attaches the donor feather **202** to the receiving feather **201** such that the feather imping pin **101** is inserted into a broken shaft **203** of the receiving feather **201**. In most cases, the receiving feather **201** is still attached to an avian but a natural end portion of the avian's feather is missing, damaged or otherwise ineffective.

FIG. **2** illustrates an exemplary embodiment of the donor feather **202**, the receiving feather **201**, and the feather imping pin **101** after the donor feather **202** and the receiving feather **201** are connected to each other by the feather imping pin **101**.

Feather imping is performed using the feather imping pin **101** that connects the donor feather **202** and the receiving feather **201**. The feather imping pin **101** fits inside both the broken shaft **203** of the receiving feather **201** and the newly cut shaft **204** of the donor feather **202**. The feather imping pin **101** fits tightly inside both the broken shaft **203** and the newly cut shaft **204**. The feather imping pin **101** may be inserted inside the broken shaft **203** and newly cut shaft **204** symmetrically or asymmetrically. For example, a ratio of a length of the feather imping pin **101** that is inserted into the broken shaft **203** to a length of the feather imping pin **101** that is inserted into the newly cut shaft **204** may be 1:1, 0.8:1, 1:0.8, 1:0.5, or 0.5:1. The feather imping pin **101** may include one or more marks to indicate a length to be inserted into the broken shaft **203** and the newly cut shaft **204**. The feather imping pin **101** may be further secured/fixed with glue or other adhesive. Examples of glues and adhesives that can be used to further secure the feather imping pin **101** include, but are not limited to, cyanoacrylate, super glue, and epoxy.

The receiving feather **201** is usually attached to an avian but may also be a feather that is detached from an avian. The feather imping process may be performed to fix the feather of the avian as a medical aid. The avian may be sedated while the feather imping is being performed. Alternatively, the feather imping may be performed to only fix a detached feather. The feather imping may be used to connect one or more than one donor feather to the receiving feather or donor feather. For example, feather imping may be performed to connect a second donor feather to a first donor feather that is already connected to the receiving feather.

FIG. **3** illustrates an exemplary embodiment of the feather imping pin **101** having a shaft that is cylindrical with two tapered ends **102** and **103** such that the two ends **102** and **103** have the same shape and size. The feather imping pin **101** may have different dimensions based on a type and a size of the receiving feather **201** and the donor feather **202**. For example, the feather imping pin **101** may be 5, 10, 20, 30, 40, 50, 100, 150, 200 mm long. In other embodiments, a length of the feather imping pin **101** may be any value in the range from 2 mm to 300 mm. The feather imping pin **101** diameter may be in the range from 0.1 mm to 5 mm. Various sizes of feather imping pins may be included in a kit, where the sizes are pre-set depending on the avian species being treated. It should be noted that a size and a diameter of the feather imping pin **101** may be different in other embodiments and the functionality of the feather imping pin **101** is independent of a size and a dimension of the feather imping pin **101**. The taper of the two ends **102** and **103** of the feather imping pin **101** may be cone-shaped with a sharp tip, cone-shaped with a rounded tip, or oval-shaped (half-egg-shaped). The two ends **102** and **103** of the feather imping pin **101** may have the same shape or may have different shapes. The feather imping pin **101** may have different colors to match a color of the feather or a color of the feather shaft. Optionally, the feather imping pin **101** may include a GPS receiver and a wireless transmitter with a battery power source so the avian that receives the feather imping pin **101** may be tracked and/or located remotely.

The feather imping pin **101** may be made of materials having a similar density as of the feather. Additionally, the feather imping pin **101** may be made of materials having a similar flexibility as of the feather. Alternatively, feather imping may be performed using the feather imping pin **100** that is flexible or non-flexible. Examples of materials that the feather imping pin **101** can be made of include, but are not limited to, titanium, aluminum, fiber glass, carbon fiber composite, and/or plastic.

FIG. **4** illustrates an exemplary embodiment of a feather imping pin **111** having two ends **102** and **130** such that the two ends **102** and **130** have different sizes, and that the diameter of the feather imping pin **111** at the one end **130** is smaller than the diameter of the feather imping pin **101** at the other end **102**. The diameter of the feather imping pin **111** at each of the two ends **102** and **130** is selected based on an inner or outer diameter of the broken shaft **203** of the receiving feather **201** and an inner or outer diameter of the newly cut shaft **204** of the donor feather **202**. For example, a diameter of the broken shaft **203** of the receiving feather **201** may be larger than a diameter of the newly cut shaft **204** of the donor feather **202**. In this case the feather imping pin **111** is inserted into the broken shaft **203** from the end having the larger diameter, which is **102**.

FIG. **5***a* and FIG. **5***b* are close-up views of exemplary embodiments of feather imping pins **112** and **113** with tilted teeth **104**, where the tilted teeth **104** are tilted in a same direction or in opposite directions, respectively. The tilted teeth **104** may be a first group of teeth close to the one end of the shaft tilted at a first angle, for example, 15°, 20°, 30°, or 45°, against the surface of the shaft, and a second group of teeth close to the other end of the shaft tilted at a second angle, for example, 15°, 20°, 30°, or 45°, against the surface of the shaft. Preferably, the first angle and second angle is between 5° and 50°.

It should be noted that when the feather imping pins **112** and **113** does not have tilted teeth **104**, upon pressure to the feather after performing the feather imping, the donor feather **202** may rotate around the feather imping pins **112** and **113** or move along the feather imping pins **112** and **113**, causing the feather to break again after the feather imping, which results in a need for re-imping the broken feather. Performing the feather imping with feather imping pins **112** and **113** having the tilted teeth **104** provides an advantage that the feather imping results in a more durable feather imping and a lower likelihood of a re-break of the feather. The feather imping pins, as disclosed in this application, may be made entirely from one material or may be made of a combination of different materials. For example, the tilted teeth **104** of the feather imping pins **112** and **113** may be made of a metal that is assembled on a plastic rod. Additionally, the tilted teeth **104** may cover the surface of the feather imping pins **112** and **113** entirely or partially.

FIGS. **6***a*, **6***b*, and **6***c* illustrate exemplary cross sectional close-up views of an exemplary embodiment of the feather imping pin **112** with tilted teeth **104**, where the tilted teeth **104** are tilted in a same direction, and the feather imping pin **112** is being inserted into the broken shaft **203**. As shown in FIG. **6***a*, while inserting the feather imping pin **112** into the broken shaft **203** of the receiving feather **201**, the tilted teeth **104** are

not engaged with the inner surface of the broken shaft **203**. In this case, while inserting the feather imping pin **112** into the broken shaft **203**, the tilted teeth **104** slide in the inner surface of the broken shaft **203**. In order to secure/fix the feather imping pin **112** in the broken shaft **203**, the feather imping pin **112** is inserted to the broken shaft **203** and then moved back/out. While retracting the feather imping pin **112**, the sharp heads of the tilted teeth **104** of the feather imping pin **112** are engaged with, and penetrate into, the inner surface of the broken shaft **203**, which result in securing the feather imping pin **112** inside the broken shaft **203**. The same procedure can be applied when inserting the feather imping pin **112** into the newly cut shaft **204**.

FIGS. **7**, **8**, **9**, and **10** illustrate exemplary close-up views of various embodiments of the feather imping pins **114**, **115**, **116**, **117** with roughened surfaces of longitudinal grooves **114**, circular grooves **106**, spiral grooves **107**, and half-cone grooves **108**, respectively. The roughened surfaces may cover the surface of the feather imping pins entirely or partially. For example, the roughened surface may only cover the areas close to the two ends **102** and **103** of the feather imping pins. The feather imping pins, as disclosed in the present application, may have only one of the above-noted roughened surfaces or may have any combination of the above-noted roughened surfaces. For example, the feather imping pins, as disclosed in the present application, may have half-cone grooves **108** at one half and may have spiral grooves **107** at the other half. It should be noted that the surface of the feather imping pins may be roughened with similar geometries and the above-noted examples are not aimed to limit the scope of the present application. Any similar roughened surfaces to secure the feather imping pin within the newly cut shaft **204** and/or the broken shaft **203**, which prevents rotation of the receiving feather **201** and/or the donor feather **202** around the feather imping pin, and/or prevents movement of the receiving feather **201** and/or the donor feather **202** along the feather imping pin are also in the scope of this application. Additionally, the two ends **102** and **103** of the feather imping pin may be roughened.

FIG. **11** illustrates an exemplary embodiment of a feather imping pin **118** that is extendable via one spring-loaded section **301** along the feather imping pin **118**. The feather imping pin **101** may be extended via one or more spring loaded sections **301** along the feather imping pin **118**. Additionally, the spring loaded section **301** may be used to add flexibility to the feather imping pin **118**.

FIG. **12** illustrates an exemplary embodiment of a feather imping pin **119** that is roughened at two ends using two springs **401** and **402**. In this case, the surface of the feather imping pin **119** may be roughened similarly using the above-noted geometries for roughening the surface of the feather imping pin **119**.

FIG. **13** is a flowchart of a method for imping the donor feather **202** and the receiving feather **201** using a feather imping pin according to one embodiment. At step S**301**, the donor feather **202** and the receiving feather **201** are prepared. The preparation may include cutting the donor feather **202** and/or the receiving feather **201** to appropriate length. The donor feather **202** and/or the receiving feather **201** may be cut such that the sizes of the cross-sections of their corresponding shafts match. The circumference of the shafts may be measured and marked prior to cutting. It is preferred that the donor feather **202** and the receiving feather **201** to be from a same type and a same kind. However, different types and kinds of the donor feather **202** and the receiving feather **201** may be attached.

At step S**303**, the feather imping pin (any of the embodiments disclosed in the present application) is partially inserted into the broken shaft **203** of the receiving feather **201**. Glue may be applied to the pin prior to insertion. The feather imping pin may be extended to a desirable length before insertion. The extension may be via releasing one or more spring-loaded extension portions along the shaft of the feather imping pin.

At step S**305**, the donor feather **202** is attached to the exposed end of the feather imping pin. Glue may be applied (in any embodiment) to the feather imping pin prior to attachment. Alternatively, the feather imping pin may be partially inserted into the newly cut shaft **204** of the donor feather **202**, and then, the receiving feather **201** may be attached to the exposed end of the feather imping pin.

The feather imping pin is first partially inserted into the broken shaft **203** of the receiving feather **201**. Then, the donor feather **202** can be attached to the exposed end of the feather imping pin, which is inserted into the newly cut shaft **204** of the donor feather **202**. Alternatively, the feather imping pin may be first partially inserted into the newly cut shaft **204** of the donor feather **202**, and then, the receiving feather **201** can be attached to the exposed end of the feather imping pin, which is inserted into the broken shaft **203** of the receiving feather **201**. Glue may be applied to the feather imping pin prior to any of the above-noted insertions or attachments.

It is preferred that the donor feather is selected/cut such that, after attachment, the donor feather **202** and the receiving feather **201**, collectively, look like an undamaged/full receiving feather **201**. It is preferred that, if the feather imping is performed on an avian that is alive and has many broken feathers that needs to be fixed, the avian being sedated.

According to another embodiment of the present application, a kit may be provided for quick feather imping. The kit may include any embodiment of the disclosed feather imping pins as described in this application. Additionally, the kit may include a plurality of feather imping pins having different sizes and lengths. The kit may further include a feather imping cutter. The kit may further include a measurement device to measure the sizes, for example, a cross-section size of the receiving feather **201** and/or the donor feather **202**. The kit may further include a marker to mark the receiving feather **201** and/or the donor feather **202** before cutting. The kit may include glue for more secure and coherent feather imping. The kit may be used to fix avian having broken feathers by imping broken feathers.

The foregoing discussion discloses and describes merely exemplary embodiments of the present application. As will be understood by those skilled in the art, the present disclosure may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. Accordingly, the disclosure of the present disclosure is intended to be illustrative, but not limiting of the scope of the disclosure, as well as other claims. The disclosure, including any readily discernible variants of the teachings herein, defines, in part, the scope of the foregoing claim terminology such that no inventive subject matter is dedicated to the public.

The invention claimed is:

1. A feather imping system for preparing a damaged natural bird feather, the system comprising:

a plurality of feather imping pins of differing circumferences and lengths, each feather imping pin having a roughened surface and a plurality of teeth protruding outward along a shaft, and is made of a material selected from a group of titanium, aluminum fiberglass, carbon fiber composite and plastic

a plurality of donor feathers of differing circumferences and lengths respectively matching the differing circumferences and lengths of the plurality of feather imping pins,

a feather size measurement device that is configured to measure at least a circumference of the damaged natural bird feather,

a feather marker configured to mark a cut location on the damaged bird feather between a damaged portion of the damaged natural bird feather and a remaining portion of the damaged natural bird feather,

a feather cutting device configured to separate the damaged portion from the remaining portion, and

whereby, a pin of the plurality of imping pins is selectable to have an end sized for insertion into the remaining portion of the natural bird feather and another end sized for insertion into an exposed hollow shaft of a selected donor feather of the plurality of donor feathers, to attach the exposed hollow shaft to the remaining portion and thereby repair the damaged natural bird feather.

2. The feather imping system of claim **1**, further comprising:

a feather glue that when applied provides an adhesive force between the pin selected for insertion and the exposed hollow shaft of the selected donor feather, and between the pin selected for insertion and the remaining portion of the damaged natural bird feather.

3. The feather imping system of claim **1**, wherein the plurality of teeth of each feather imping pin are tilted against a surface of the shaft.

4. The feather imping system of claim **3**, wherein the plurality of teeth comprise:

a first group of teeth tilted at a first angle against the surface of the shaft; and

a second group of teeth tilted at a second angle against the surface of the shaft.

5. The feather imping system of claim **1**, wherein each of the plurality of feather imping pins further comprising:

one or more extendable portions along the shaft.

6. The feather imping system of claim **5**, wherein the one or more extendable portions comprises:

one or more spring loaded portions.

7. The feather imping system of claim **1**, wherein each of the plurality of feather imping pins further comprising:

one or more roughened ends.

8. The feather imping system of claim **7**, wherein the one or more roughened ends comprises:

one or more springs attached to the one or more roughened ends.

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